Rec'd 5000 7-11-68

FACT SHEET

L-743

Crop Fertilization on Texas Blackland and Grand Prairie Soils

Charles D. Welch, Carl Gray, Grant W. Thomas,
Warren B. Anderson and Gordon McLean*

The Blackland and Grand Prairie regions, indicated in figure 1, include 20 million acres of soils widely varied in characteristics. Most soils are upland, but more than 2 million acres of alluvial soils are included. Three-fourths of the Grand Prairie and about half the Blackland are rangeland.

Characteristics of Soils

Most soils are high in clay, and productivity generally is regulated by available moisture. When soils are dry, initial water intake is high. However, the presence of montmorillionitic-type clay results in swelling and closure of pores and cracks and a reduced infiltration rate during swelling.

*Extension soil chemists, professor and assistant professor, Texas A&M University, College Station; and assistant professor, Livestock and Forage Research Center, McGregor.

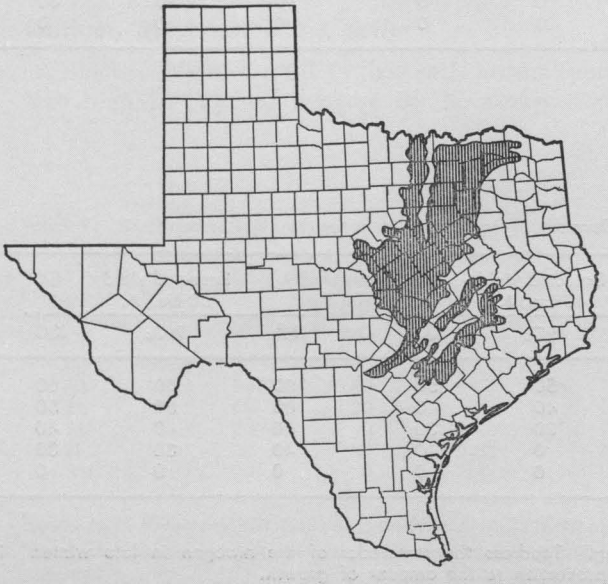

Figure 1. Location of Blackland and Grand Prairie regions.

The mineral and rock deposits from which these soils are formed are generally high in carbonates; therefore, soils have a high base status. Soils high in swelling clays require that careful attention be given to a sound residue management program. This is essential for the maintenance of desirable soil structure and physical characteristics.

Soil Fertility Status

Soil characteristics, past fertilization and cropping practices have resulted in a wide range of fertility levels in these soils. Additions of nitrogen and phosphorus give responses on much of the cropland. For example, soil test summary data in Table 1 show 70 percent of samples tested to be low or very low in phosphorus. However, with the majority of the soils high in potassium, expected responses are less frequent than with nitrogen and phosphorus.

N, P_2O_5 and K_2O for Major Crops

The wide range in fertility levels throughout the Blackland and Grand Prairie soils requires that fertilization practices be adapted to specific conditions. Soil tests, properly calibrated to express

Table 1. Percentage distribution of Blackland and Grand Prairie soils in five ranges for organic matter, phosphorus, potassium and pH.

Soil test level*	Percentage of samples at each level: Organic matter	Phosphorus	Potassium	Soil pH range	Percent
VL	7	50	4	below 6.0	9
L	19	20	15	6.1-6.5	16
M	22	17	22	6.6-7.3	19
H	22	8	21	7.4-7.8	19
VH	30	5	38	above 7.8	37

*Soil test summary data from Texas Agricultural Extension Service Soil Testing Laboratories.

Texas A&M University • Agricultural Extension Service • John E. Hutchison, Director • College Station

Table 2. Application rates of nutrients for grain sorghum—three production levels

Soil test level*	Expected yield 3500 lb./A.			Expected yield 4500 lb./A.			Expected yield 5500 lb./A.		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
VL	50	40	40	80	50	50	100	60	60
L	30	30	30	60	40	40	80	50	50
M	0	20	20	30	30	30	60	40	40
H	0	0	0	0	20	20	30	30	30
VH	0	0	0	0	0	0	0	0	0

*Texas A&M University soil testing methods and calibrations.

Table 3. Application rates of nutrients for cotton—three production levels

Soil test level*	Expected yield ¾ bale/A.			Expected yield 1 bale/A.			Expected yield 1 ¼ bale/A.		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
VL	50	50	50	70	60	80	90	80	100
L	30	40	40	50	50	60	70	70	80
M	20	30	30	30	40	40	50	60	60
H	0	0	0	0	30	30	30	40	40
VH	0	0	0	0	0	0	0	0	0

*Texas A&M University soil testing methods and calibrations.

Table 4. Application rates of nutrients for corn—three production levels

Soil test level*	Expected yield 40 bu./A.			Expected yield 50 bu./A.			Expected yield 60 bu./A.		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
VL	60	40	40	80	50	50	100	60	60
L	40	30	30	60	40	40	80	50	50
M	20	20	20	40	30	30	60	40	40
H	0	0	0	20	0	0	40	30	30
VH	0	0	0	0	0	0	0	0	0

*Texas A&M University soil testing methods and calibrations.

Table 5. Application rates of nutrients for wheat—three production levels

Soil test level[1]	Expected yield 30 bu./A.			Expected yield 40 bu./A.			Expected yield 50 bu./A.		
	N[2]	P_2O_5	K_2O	N[2]	P_2O_5	K_2O	N[2]	P_2O_5	K_2O
VL	60	40	40	80	50	50	100	60	60
L	40	30	30	60	40	40	80	50	50
M	0	20	20	40	30	30	60	40	40
H	0	0	0	0	0	0	40	30	30
VH	0	0	0	0	0	0	0	0	0

[1]Texas A&M University soil testing methods and calibrations.

[2]Apply all of the P_2O_5 and K_2O and part of the N at or before planting. Topdress the remainder of the nitrogen in late winter. If small grains follow a legume, reduce nitrogen by about half and in proportion to the amount of growth.

Table 6. Application rates of nutrients for small grains for grazing—two grazing intensities

Soil test level[1]	1 a. u./2A.			1 a. u./A.		
	N^2	P_2O_5	K_2O	N^2	P_2O_5	K_2O
VL	60	40	40	100	60	60
L	40	30	30	80	40	40
M	20	0	0	60	30	30
H	0	0	0	40	0	0
VH	0	0	0	0	0	0

[1]Texas A&M University soil testing methods and calibrations.

[2]Apply all of the P_2O_5 and K_2O and up to 40 pounds of the N at or before planting. Topdress the remainder of the N in late winter.

Table 8. Application rates of nutrients for common bermuda grass—two grazing intensities (no legume)

Soil test level[1]	1 a. u./3 A.			1 a.u./1 ½ A.		
	N^2	P_2O_5	K_2O	N^2	P_2O_5	K_2O
VL	70	40	60	160	60	80
L	40	30	40	130	40	60
M	0	0	0	100	30	40
H	0	0	0	70	0	0
VH	0	0	0	0	0	0

[1]Texas A&M University soil testing methods and calibrations.

[2]For continuous grazing during favorable seasons. Rates of N above 40 pounds should be divided with a portion in the early spring (omit with a good legume) and after each grazing period, except the last.

available nutrients, and correlated with crop response, are the best guide to profitable fertilization. The two important criteria for selecting the profitable rate of a nutrient are: (1) the level of available nutrients and (2) expected yield goal. A number of soil properties, along with the amount of extractable nutrient, must be evaluated to group soils for expressing the level of available nutrient. The second criterion is the expected yield, which expresses potential productivity and includes anticipated moisture and management conditions.

Rates of N, P_2O_5 and K_2O at varying soil test levels and expected yields for major crops are shown in Tables 2-9. To use these tables, determine the soil test level in the left column and read across to the expected yield column for the rate of nutrient. For example, in Table 2 a soil with a low (L) level of nitrogen, low (L) level of phosphorus and very high (VH) level of potassium would show 60-40-0 for 4,500 pounds per acre of grain sorghum.

Calcium, Magnesium and Sulfur

Blackland and Grand Prairie soils normally are very high in calcium because of the composition of the parent material. The magnesium levels appear adequate for current production levels. Sulfur, the third secondary nutrient, has been studied less than other major nutrients. However, sulfur released from organic matter and that supplied by normal sources of plant nutrients are adequate to prevent widespread deficiencies. Sulfur responses have not been reported for the Blackland and Grand Prairie regions.

Micronutrients

The micronutrient group includes seven elements: iron, zinc, manganese, copper, boron, molybdenum and chlorine. The amounts of these micronutrients in Blackland and Grand Prairie soils appear to be adequate for current levels of production of field crops. However, there are conditions resulting in deficiencies and responses to zinc and/or iron. See Extension leaflets, L-721 and L-723, available from county agricultural agents, for a more complete discussion of these nutrients.

The principle involved in using micronutrients is the same as for major nutrients; that is, to identify and confirm the need and, then to apply

Table 7. Application rates of nutrients for forage (Sudan types) sorghum—three production levels

Soil test level[1]	Expected yield 2 ton/A.			Expected yield 4 ton/A.			Expected yield 6 ton/A.		
	N^2	P_2O_5	K_2O	N^2	P_2O_5	K_2O	N^2	P_2O_5	K_2O
VL	80	40	40	160	80	80	240	100	100
L	60	30	30	140	60	60	220	80	80
M	40	0	0	120	40	40	200	60	60
H	0	0	0	100	0	0	180	40	40
VH	0	0	0	0	0	0	0	0	0

[1]Texas A&M University soil testing methods and calibrations.

[2]Rates of N above 40 pounds should be divided into a preplant application and one or more topdressings after each harvest, except the last.

Table 9. Application rates of nutrients for the production of coastal bermudagrass—three production levels (no legume)

Soil test level[1]	Expected yield 2 ton/A.			Expected yield 4 ton/A.			Expected yield 6 ton/A.		
	N^2	P_2O_5	K_2O	N^2	P_2O_5	K_2O	N^2	P_2O_5	K_2O
VL	80	40	60	180	60	120	280	80	160
L	60	30	30	150	40	80	240	60	120
M	0	0	0	120	30	60	200	40	100
H	0	0	0	90	0	30	160	0	80
VH	0	0	0	0	0	0	120	0	0

[1]Texas A&M University soil testing methods and calibrations.

[2]Rates of N above 60-80 pounds should be divided with a portion in the spring (omit with a good legume) and after each harvest, except the last.

amounts sufficient to meet the production requirement.

Conversion Factor

Fertilizers are labeled as percent P_2O_5 and K_2O and soil test values are reported in these terms. However, plant anlyses results usually are reported as percentages of the element. For this reason the following factors are presented for use in converting from one form to the other.

From P_2O_5 to P multiply by .44

From P to P_2O_5 multiply by 2.3

From K_2O to K multiply by .83

From K to K_2O multiply by 1.2

Cooperative Extension Work in Agriculture and Home Economics, Texas A&M University and the United States Department of Agriculture cooperating. Distributed in futherance of the Acts of Congress of May 8, 1914, as amended, and June 30, 1914.
5M—5-68